EPA Clean Power Plan: 111(d)

PSE's Draft Analysis

November 10, 2015
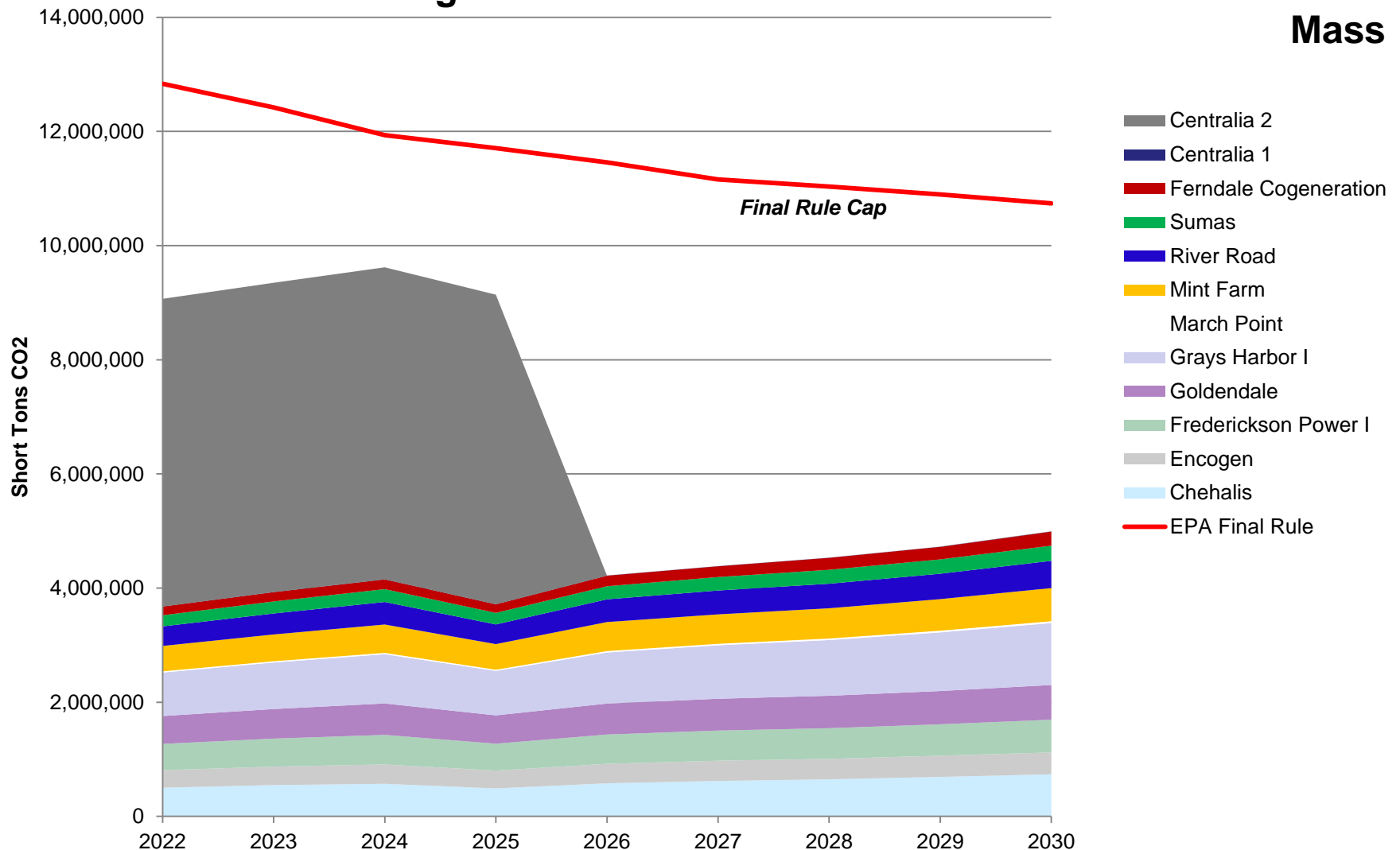
Serving more than 1 million Electric Customers and more than 790,000 Natural Gas Customers in Western Washington With Diverse Energy Resources

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PSE Emission Estimates for Washington

- Emissions and energy outputs from Aurora dispatch modeling (to 2030)
  - Covers entire western power market and hourly electricity forecasts
- For CPP benchmarks PSE selected the 2015 Base Case + No CO_2 Tax Scenario
  - Key assumptions include:
    - Mid-range prices for natural gas
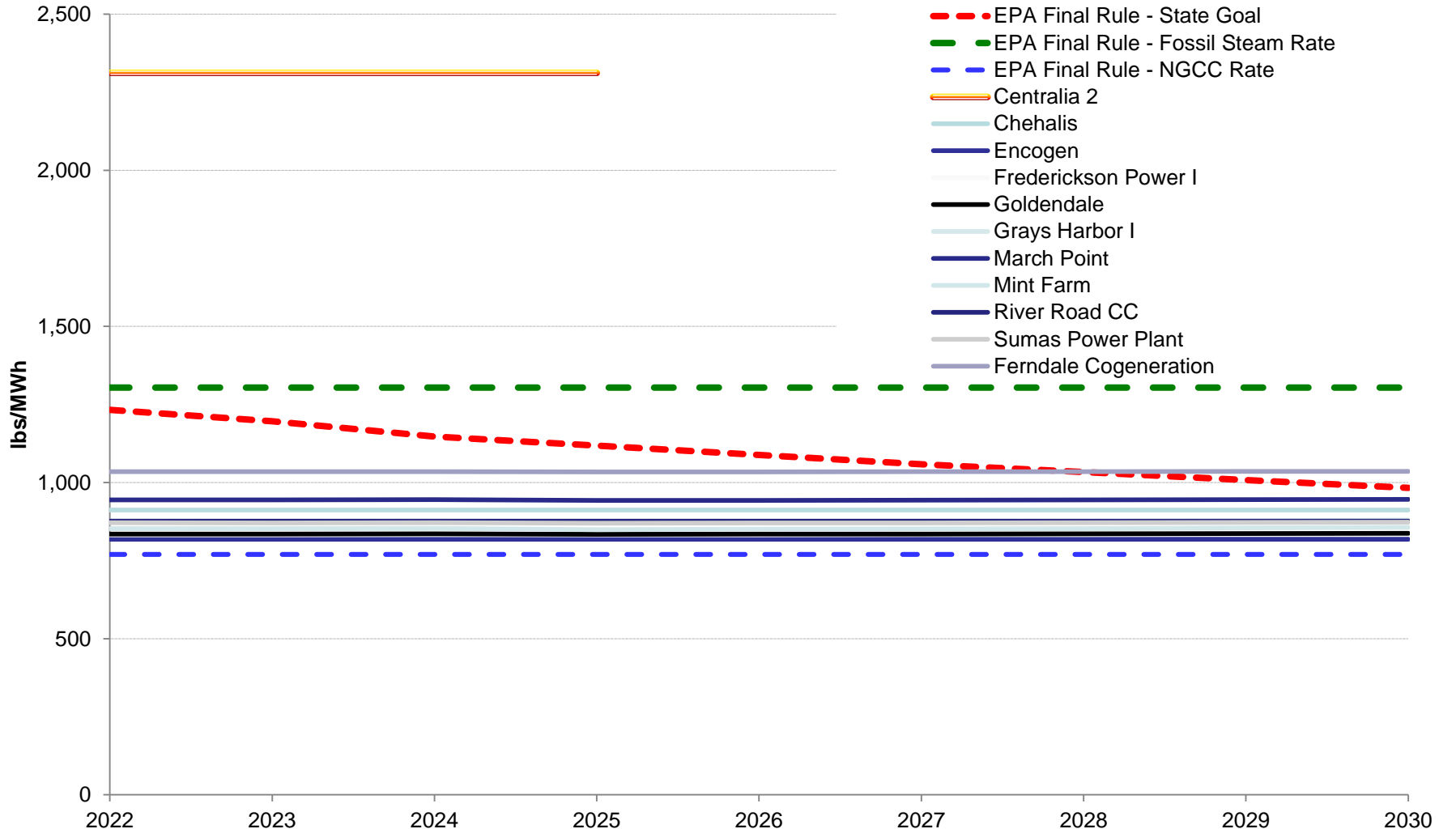   - Mid-range electric demand
    - No CO_2 Tax

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PSE's Aurora Dispatch Analysis – Mass All Affected Units

Washington Emissions Estimate From Affected Units - Total Mass

Legend:
- Centralia 2
- Centralia 1
- Ferndale Cogeneration
- Sumas
- River Road
- Mint Farm
- March Point
- Grays Harbor I
- Goldendale
- Frederickson Power I
- Encogen
- Chehalis
- EPA Final Rule

Final Rule Cap

Y-axis: **Short Tons CO2** (0 to 14,000,000)
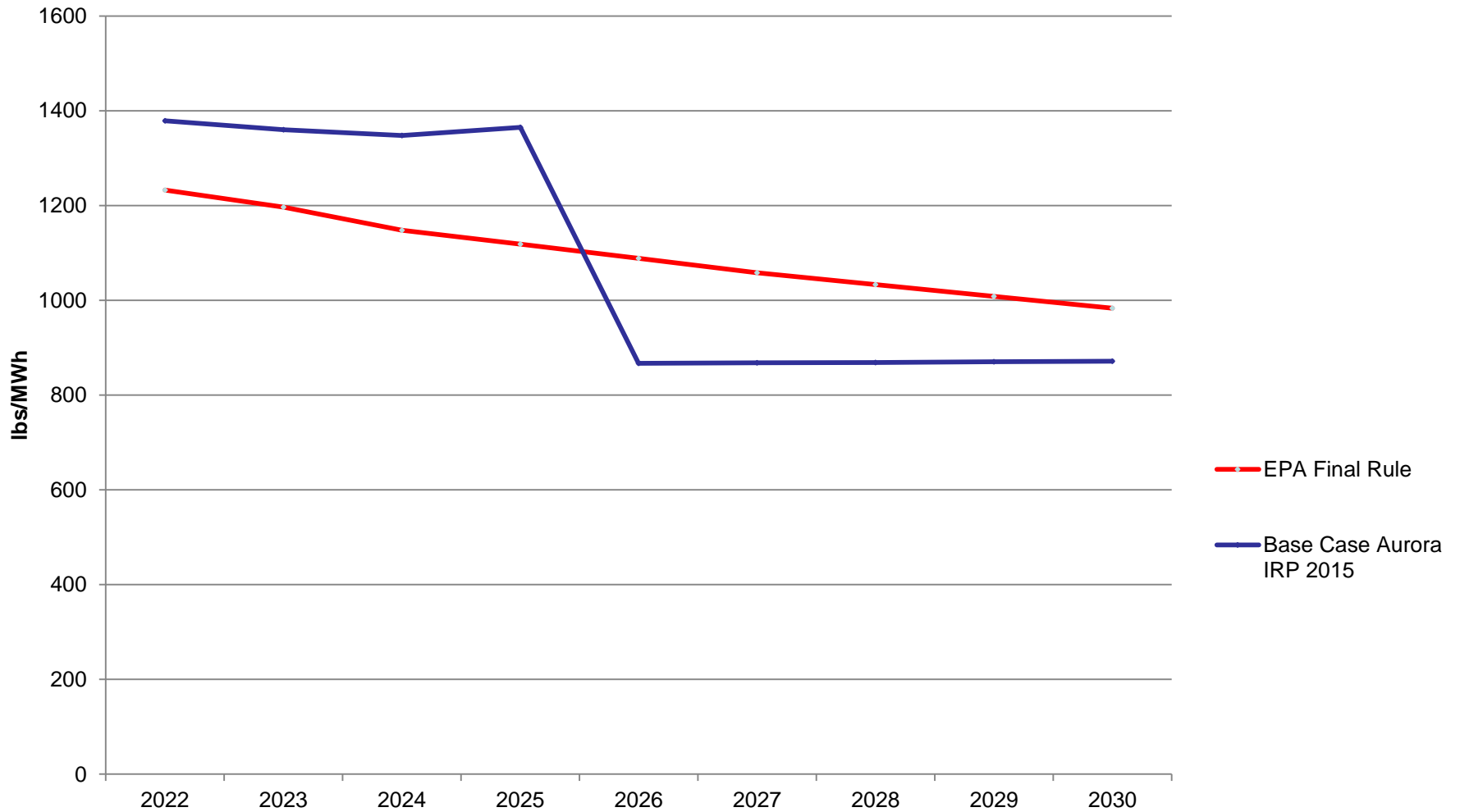
X-axis: 2022 – 2030

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PSE's Aurora Dispatch Analysis – Rate All Affected Units

Washington - Emission Rate Estimates for Affected Units

Legend:
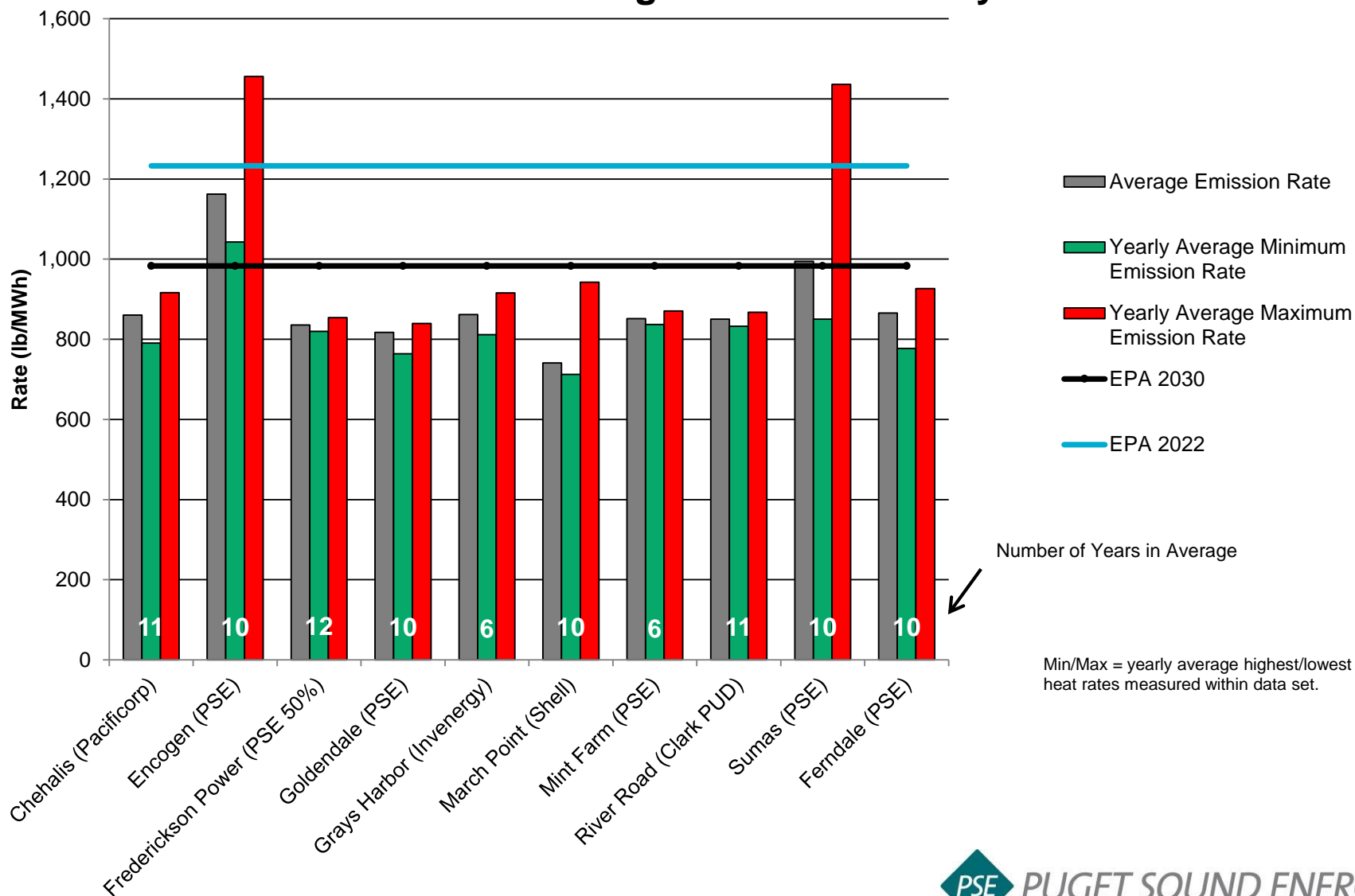- EPA Final Rule - State Goal
- EPA Final Rule - Fossil Steam Rate
- EPA Final Rule - NGCC Rate
- Centralia 2
- Chehalis
- Encogen
- Frederickson Power I
- Goldendale
- Grays Harbor I
- March Point
- Mint Farm
- River Road CC
- Sumas Power Plant
- Ferndale Cogeneration

Y-axis: lbs/MWh (0 to 2,500)

X-axis: 2022 to 2030

PSE's Aurora Dispatch Analysis – Rate All Affected Units

Washington Emission Rate Estimates

Legend:
- EPA Final Rule
- Base Case Aurora IRP 2015

Y-axis: lbs/MWh (0 to 1600)
X-axis: 2022 to 2030

Historic Emission Rate Averages - All Gas Units

Washington - Combined Cycle Emission Rates

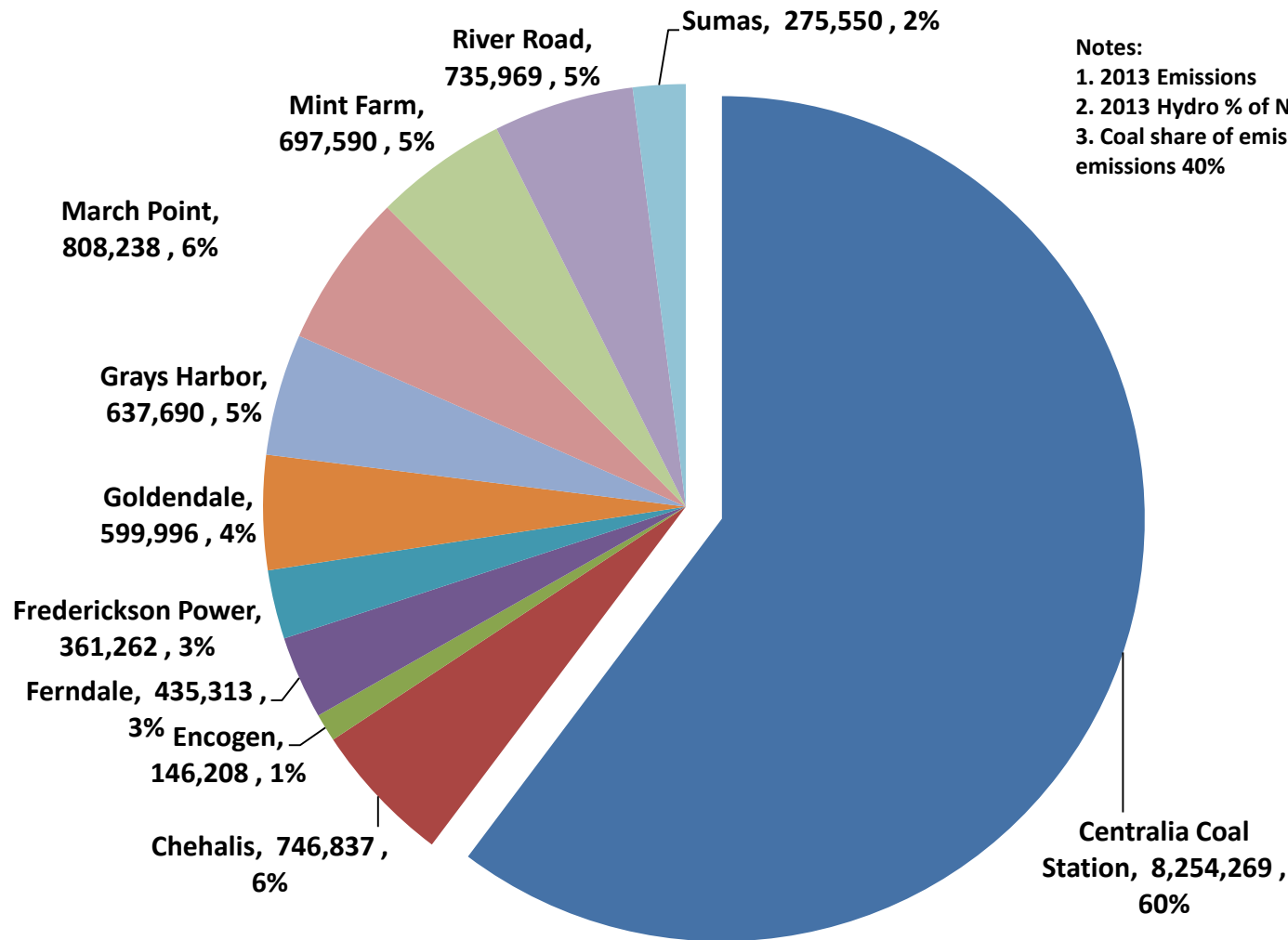# Appendix - Washington

Aurora Output - Capacity Factor by Fuel

Average of Capacity_Factor	Column Labels		
Row Labels	Coal	NG CCCT	Grand Total
2021	78%	31%	36%
2022	79%	35%	39%
2023	80%	37%	41%
2024	80%	39%	43%
2025	80%	35%	39%
2026		40%	40%
2027		41%	41%
2028		42%	42%
2029		44%	44%
2030		47%	47%
2031		50%	50%
2032		52%	52%
2033		54%	54%
2034		56%	56%
2035		58%	58%
Grand Total	**80%**	**44%**	**45%**

Aurora Output

Run_ID	Name	Fuel type	Output MWa	Capability MWa	Capacity MW	Nameplat MW	Net_Heat Btu/kWh	Incr_Heat Btu/kWh	Output_M MWh	Capacity_	Primary_Fuel	Index	CO2 Tons	Rate
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	524.2451	550.5265	670	670	10810	10810	4592387	0.782455	Coal variable cost -	Centralia 2_2021	5309394	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	532.2658	553.4116	670	670	10810	10810	4662649	0.794427	Coal variable cost -	Centralia 2_2022	5390626	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	535.0637	554.4158	670	670	10810	10810	4687159	0.798603	Coal variable cost -	Centralia 2_2023	5418962	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	538.3276	554.566	670	670	10810	10810	4728670	0.803474	Coal variable cost -	Centralia 2_2024	5466955	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	535.5497	554.7096	670	670	10810	10810	4691416	0.799328	Coal variable cost -	Centralia 2_2025	5423884	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2026	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2027	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2028	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2029	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2030	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2031	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2032	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2033	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2034	0	213.
Case7 MML 081615 Col1_2Ret	Centralia 2	Coal	0	0	0	0		0	0		Coal variable cost -	Centralia 2_2035	0	213.
Case7 MML 081615 Col1_2Ret	Chehalis Gen	NG CCCT	108.0526	379.0715	507.6446	507.6446	7800	7800	946541.1	0.212851	NG variable cost - P	Chehalis Generating	431537.6	116.
Case7 MML 081615 Col1_2Ret	Chehalis Gen	NG CCCT	125.9727	373.0119	507.6446	507.6446	7800	7800	1103521	0.248151	NG variable cost - P	Chehalis Generating	503106.3	116.
Case7 MML 081615 Col1_2Ret	Chehalis Gen	NG CCCT	137.5292	367.832	507.6446	507.6446	7800	7800	1204756	0.270916	NG variable cost - P	Chehalis Generating	549260.2	116.
Case7 MML 081615 Col1_2Ret	Chehalis Gen	NG CCCT	142.687	371.4299	507.6819	507.6819	7800	7800	1253362	0.281056	NG variable cost - P	Chehalis Generating	571420.4	116.
Case7 MML 081615 Col1_2Ret	Chehalis Gen	NG CCCT	122.8909	376.6015	507.6446	507.6446	7800	7800	1076525	0.242081	NG variable cost - P	Chehalis Generating	490798.3	116.
Case7 MML 081615 Col1_2Ret	Chehalis Gen	NG CCCT	145.3493	374.0202	507.6446	507.6446	7800	7800	1273260	0.286321	NG variable cost - P	Chehalis Generating	580491.9	116.

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Washington C0$_2$ (by Facility, tons)

Sumas, 275,550, 2%

River Road, 735,969, 5%

Mint Farm, 697,590, 5%

March Point, 808,238, 6%

Grays Harbor, 637,690, 5%

Goldendale, 599,996, 4%

Frederickson Power, 361,262, 3%

Ferndale, 435,313, 3%

Encogen, 146,208, 1%

Chehalis, 746,837, 6%

Centralia Coal Station, 8,254,269, 60%

Notes:
1. 2013 Emissions
2. 2013 Hydro % of Normal at Dalles = 96%
3. Coal share of emissions 60%, gas share of emissions 40%

Washington – Mass Limits

State Mass Goal = (State Goal Rate * Adjusted 2012 Generation) + (State Goal Rate * State's Share of Not Captured BB3 * 2)

Emission Mass at 2012 Generation Level

Allowable Emission Growth at Existing Units Enabled By RE Generation Not Captured in Source Category Specific Performance Rates

State: Washington **Year:** 2022

Washington Mass Goal 2022 = (1,233 lbs/MWh * 19,462,111 MWh
+ (1,233 lbs/MWh * 680,704 MWh * 2)

= 12,834,306 short tons

Washington Interim Mass Goal (Annual) (avg of 2022-2029)	= 11,679,707 short tons
Washington Final Mass Goal (Annual) (2030)	= 10,739,172 short tons

Washington Mass Goal 2022-2030

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